English translation of Microfilm of Utility Model Application Showa 48-15522

Japanese Utility Model Laid-Open No. 49-116445

(1,500 yen)

Request for Utility Model Registration (1)

February 5, 1973

To: Yukio MIYAKE, Commissioner of Patent Office

1. Title of the Device:

   Laminated Plate-like Body

2. Creator of Device:

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   Name: Eiichi KUDO (Another)

3. Applicant of Utility Model Registration:

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   Representative: Junji ITO

4. Agent:

   Postal code: 534

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   3-80, Tomobuchi-cho 1-chome, Miyakojima-ku, Osaka

   Name: Koichi MIZUKUCHI (6180)

Specification

1. Title of the Device:

   Laminated Plate-like Body

2. Claim of Utility Model:

A laminated plate-like body having excellent shock-absorption, sound insulation, and thermal insulation properties, wherein the body comprises a fiber-incorporated gypsum layer as the core and cement layers laminated on both surface thereof, the cement layer containing glass fibers with the glass composition of:

60 to 67 mol % of $SiO_2$,

16 to 20 mol % of $R_2O$,

12 to 16 mol % of $ZrO_2$,

2 to 5 mol % of $P_2O_5$,

1 to 4 mol % of $B_2O_3$,

1 to 3 mol % of R'O,

0.5 to 6 mol % of $SnO_2$, and

0.5 to 2 mol % of $CaF_2$,

wherein R represents Na or K and R' represents Ca, Mg, Ba, or Zn, respectively.

3. Detailed Description of the Device:

The present device relates to a fire-resistant board for outdoor structures or buildings, which comprises a laminated body comprising gypsum and cement and dispersing glass fibers to reinforce the body.

Conventionally, cement and gypsum have histories as major fire-resistant materials. They are generally strong in compression but disadvantageously brittle and weak in stretch bending. In order to improve such characteristic, a method of polymer-mixing or a method of dispersing fibers is carried out. For these methods,

fiber-reinforced inorganic materials such as asbestos/cement, wood wool/cement, asbestos/magnesium carbonate, asbestos/calcium silicate, and asbestos/gypsum are frequently used as building materials. In other words, asbestos is the most frequently used as reinforcing fibers. However, asbestos varies in terms of quality and relates to pollution problems. Further, there are fears of depletion of asbestos supply. Thus, a hopeful view has recently been taken on artificial fibers such as glass fibers and synthetic fibers.

Glass fibers have a tensile strength of 200 to 350 kg/mm$^2$ as a general performance reinforces matrix of cement, gypsum, etc. and is useful to prevent crack propagation. For instance, when 3 to 10 % by weight of glass fibers is dispersed, the bending strength (180 to 300 kg/cm$^2$) can be obtained, which is equivalent to asbestos cement having 15 % or more of asbestos dispersed therein. However, even when a material has such high strength, it is natural that the shock-absorption thereof is small if its thickness is not sufficient. In addition, sound insulation and thermal insulation become reduced, and thus the material is usually used together with other materials on its application, or its application is carried out with a suitable thermal insulation space. Further, as the thickness is increased, shock-resistance, sound insulation, and thermal insulation performances can be enhanced. However, these materials are used as composite materials with cement having an inherently high specific gravity and are manufactured so as to have a high density for strength improvement. Therefore, the composites completely lose light panel characteristics and their applications are limited.

In addition, when, as a material reinforcing cement, a common glass fiber, for example, a fiber of E glass is used and mixed with cement mortar, the reinforced glass fiber is eroded by the basicity of generated calcium hydroxide, particularly during a period of long-term use, resulting in disadvantages such as strength reduction and deteriorated performance of the material.

On the other hand, synthetic fibers such as nylon, polypropylene, vinylon and polyester, have good breaking strength and high ductility, and thus they exhibit high

shock-resistance and breaking energy absorption properties when they are dispersed in a matrix of cement, gypsum, etc. However, they cannot improve absolute values of Young's modulus and stretch bending strength of a material. Therefore, glass fibers and synthetic fibers may be mixed to make use of high strength and Young's modulus of glass fibers and high ductility and elasticity of synthetic fibers, but the resultant product tends to be merely a compromised material.

In the meanwhile, lightness is required as a structural material and foamed cement, foamed gypsum, etc. have been put into practice. They are disadvantageously brittle and easy to be collapsed, compared to ones made of the same materials with no bubble. For example, when they are compared with conventional asbestos slate and gypsum board, the bending strength significantly decreased to about 1/8 to 1/20 and thus it is almost impossible to use them as a single plate-like body.

The creators of the present device have made researches on building materials that satisfy the above characteristics, and they have focused attention to breaking energy absorption, sound insulation, thermal insulation properties as well as shock-resistance of foamed fire-resistant light-weight body, and excellent strength property of glass fiber-reinforced cement. Further, they have found that glass with a specific composition has an excellent alkali resistance. They have made further researches to complete the present device.

An object of the present device is to provide an inorganic plate-like body which has light-weight, shock resistance, good strengths for bending and stretch, and excellent sound and thermal insulation properties.

Namely, the present device is a laminated plate-like body having excellent shock-absorption, sound insulation, and thermal insulation properties, wherein the body comprises a fiber-incorporated gypsum layer as the core and cement layers laminated on both surface thereof, the cement layer containing glass fibers with the glass composition of:

60 to 67 mol % of $SiO_2$,

16 to 20 mol % of $R_2O$,

12 to 16 mol % of $ZrO_2$,

2 to 5 mol % of $P_2O_5$,

1 to 4 mol % of $B_2O_3$,

1 to 3 mol % of R'O,

0.5 to 6 mol % of $SnO_2$, and

0.5 to 2 mol % of $CaF_2$,

wherein R represents Na or K and R' represents Ca, Mg, Ba, or Zn, respectively.

Gypsum described herein means, in addition to hemihydrate gypsum obtained by calcining and maturing natural gypsum, hemihydrate gypsum $CaSO_4 \cdot 1/2H_2O$ obtained by calcining and maturing chemical gypsums such as phosphate gypsum, fluorinated gypsum, and flue gas desulfurization gypsum. In addition, other inorganic substances such as clay, diatomaceous earth, calcium carbonate, barium sulphate, magnesium sulphate, talc, sand, glass powder, balls, and Oyaishi powder can be mixed, which have performance as so-called packing material, to such degree as not to prevent the hydraulicity.

As fibers to be dispersed and mixed in the above gypsum, fibers cut into a piece with 2 to 40 mm in size are used. Examples thereof include glass, polyester, polypropylene, and nylon, and these may be used either alone or in proper combination of one or more kinds thereof for dispersion. The mixing amount is about 0.5 to 15 % by weight. In general, the amount of 1 to 5 % by weight is suitable for improvement of tensile strength, bending strength, and shearing strength in consideration of easiness of even dispersion. However, a larger amount in the range of 5 to 15 % by weight is preferred for improving shock-strength and breaking energy absorption property, and further helpful for weight reduction.

Further, to obtain porous gypsum, an air entraining agent such as lauryl sodium sulfate, which is generally well-known, is mixed for air bubble mixing. In addition,

foaming agents to cause chemical reaction, such as magnesium, aluminate powder, hydrogen peroxide and bleaching powder, calcium carbide, can be added, and the specific gravity thereof is approximately 0.3 to 0.6.

In other words, weight reduction is accomplished by using the above foamed gypsum, and defects of a foamed body such as easy collapse, cracking, and depression are overcome by fibers dispersion. At the same time, sound and thermal insulation properties as well as shock-absorption property can be provided.

In manufacturing foamed and fiber-reinforced gypsum, addition of an emulsion or an aqueous solution of a resin component selected from polyvinyl acetates, poly(vinyl acetate/acrylic)s, acrylics, polyurethanes or polyethylene glycols, etc., may be much effective. In particular, according to the result of the experiments conducted by the present creators, a product obtained from the following composition was preferable:

| | |
|---|---|
| foaming agent | hydrogen peroxide and bleaching powder |
| reinforcing fibers | about 1 % of glass fibers, 0.2 to 0.3 % of polyester fibers |
| resin component | water soluble polyurethane |
| others | gypsum and water. |

Cement reinforced by glass fibers with a specific composition is to be laminated on a light weight foamed gypsum as a core. The cement has as a practical component a common hydraulic cement such as portland cement, magnesia cement, and alumina cement, and usually portland cement is used since it is most frequently used. In addition, glass fibers is dispersed and mixed in the cement. The glass fibers used herein is obtained from glass having a composition comprising 60 to 67 mol % of $SiO_2$, 12 to 16 mol % of $ZrO_2$, 16 to 20 mol % of $R_2O$, 2 to 5 mol % of $P_2O_5$, 1 to 4 mol % of $B_2O_3$, 1 to 3 mol % of $R'O$, 0.5 to 6 mol % of $SnO_2$, and 0.5 to 2 mol % of $CaF_2$, wherein R represents Na or K and R' represents Ca, Mg, Ba, or Zn, respectively.

In the glass composition, the presence of $ZrO_2$ improves alkali resistance, which has been already known. Conventionally, only about 10 % of $ZrO_2$ was mixed. In

contrast, the glass fibers used for the present device can contain 12 % or more of $ZrO_2$ by combined use of $P_2O_5$ and $B_2O_5$, thereby improving alkali resistance. Further, $P_2O_5$ is bound to Ca in cement thereby to form a thin water-insoluble calcium phosphate film with excellent alkali resistance on a glass surface. Thus, a higher improvement in alkali resistance and adhesiveness can be accomplished.

The dispersion amount of the glass fibers is varied depending upon manufacturing method, but the amount is 0.5 to 15 % by weight, preferably 3 to 10 % by weight, and more preferably 3.5 to 5 % by weight based on cement. If the density is enhanced by compression and suitable curing conditions are maintained, a building board with excellent strength is obtained. The thickness thereof is not particularly limited, but a board with a thickness of 2 to 10 mm is used. The board having a specific gravity of 1.5 to 2.0 and strength properties such as bending stress of 200 to 300 $kg/cm^2$ is obtained.

When the fiber-dispersed and foamed light weight gypsum layer is used as a core and a glass fiber-reinforced cement layer is integrally laminated thereon, a commonly used paste such as starch, acrylic ester, and vinyl acetate pastes are applied on a surface of cured gypsum or may be used between the layers for crimping. A thermosetting resin such as unsaturated polyester and epoxy resin is mixed with a curing catalyst, if necessary, and the mixture is applied and heated for curing, thereby resulting integral lamination. On one surface of the uncured fiber-reinforced gypsum core, glass fibers dispersion cement slurry is arranged, and a proper pressure is applied to adjust the thickness, then resulting integral curing. Or fibers dispersed gypsum slurry is cast onto a glass dispersed cement curing plate, and the plate is turned over before curing. Then, a cement curing plate is place on the back surface thereof, thereby enabling integral lamination.

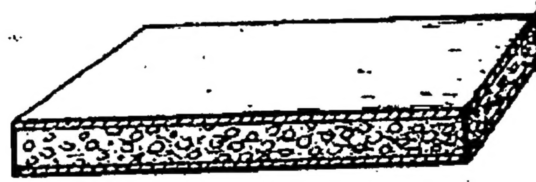
As described above in detail, a laminated plate-like body of the present device is hereinafter explained by referring the figure.

Figure 1 is a partially cutaway perspective view wherein fibers dispersed foamed gypsum layer (1) is a core and cement layers with glass fibers dispersed and mixed are laminated on both sides of the layer (1). Although a boundary surface (3) can be formed with a smooth surface or uneven surface depending upon lamination means, the laminated layers are strongly fixed by any means. It should be noted that, with respect to the thickness ratio among these layers, the gypsum core layer preferably has a ratio of 25 to 75 % to the entire thickness. If the thickness ratio thereof is less than 25 %, thermal insulation or sound insulation properties cannot be obtained. Further, it is not preferable due to small weight reduction. In contrast, if the thickness ratio exceeds 75 %, it is unfavorable that strength properties are deteriorated. It should be noted that the thicknesses of cement layers laminated on both sides may be the same or different, and depending upon its application, the thicknesses are varied. In the above plate-like body, the light weight core and the outer layer plate with high density and strength are integrally laminated, though not shown in the figure, and thus the entire plate with a specific gravity of approximately 0.6 to 1.2 can be freely obtained. The specific gravity is different depending upon the thicknesses of the core and outer layer plate. In view of the forgoing, the laminated plate-like body of the present device is light in weight compared with an asbestos slate plate with the same thickness, but has an excellent strength. Further, the laminated plate-like body has shock-absorption and sound insulation properties, and an excellent thermal insulation property derived from the containment of bubbles therein, and therefore it is highly valuable for industrial use for various building materials.

4. Brief Description of Drawing:

Figure 1 is a perspective view of a laminated plate-like body according to the present device, wherein the body comprises a foamed gypsum core (1) and glass fiber-incorporated cement layers (2) laminated on both sides thereof.

第1図




Reference 1
Fig. 1
1: Fiber-reinforced Gypsum Core
2: Fiber-mixed Cement Layer
3: Boundary Surface between Gypsum Core and Cement Layer

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Japanese Utility Model Laid-Open No. 56-130832

(4,000 yen)

Request for Utility Model Registration

March 4, 1980

To: Yoshio KAWAHARA, Commissioner of Patent Office

1. Title of the Device:

   Heat-resistant Board

2. Creator of Device:

   Residence: 2-5-6, Shinkanaoka-cho, Sakai-shi, Osaka

   Name: Yoshio FUJISHIMA (Another)

3. Applicant of Utility Model Registration:

   Residence: 17-2, Ginza 6-chome, Chuo-ku, Tokyo 104

   Name: Nippon Steel Chemical Co., Ltd. (644)

   Representative: Taiso IMAI

   Phone: 03-542-1321

4. List of Attached Documents:

   (1) Specification 1

   (2) Drawing 1

   (3) Copy of Request 1

## Specification

1. Title of the Device:

   Heat-resistant Board

2. Claims of Utility Model:

   1. A heat-resistant board, wherein a base is integral with a sprayed heat-resistant inorganic material via an adhesive layer.

   2. The heat-resistant board according to claim 1, wherein the sprayed heat-resistant inorganic material layer consists essentially of an inorganic fiber and an inorganic binder.

   3. The heat-resistant board according to claim 2, wherein the inorganic fiber is rock wool and the inorganic binder is cement.

   4. The heat-resistant board according to claim 1, wherein the base is selected from the group consisting of a woody board, a plastic board, a foamed plastic board, a cement board, a gypsum board, a fiber-reinforced cement board, a calcium silicate board, and a wood wool board.

   5. The heat-resistant board according to claim 1, wherein the sprayed heat-resistant inorganic material layer is formed by spraying, from 1000 mm or more distance, a material comprising 30 to 70 % of rock wool, 0 to 20 % of vermiculite, 20 to 40 % of portland cement or blast furnace cement, and 0 to 20 % of gypsum, together with water and air.

3. Detailed Description of the Device:

The present device relates to a heat-resistant board having light weight, acoustic absorption, incombustibility, and other features, wherein a base is integral with a sprayed heat-resistant inorganic material via an adhesive layer.

The present device is hereinafter described by one embodiment shown in a figure. In the figure, there are a base 1, an adhesive layer 2, and a sprayed heat-resistant material layer 3.

The base 1 can be made of any material such as wood, synthetic resin, metal, ceramic, or concrete. When importance is placed on lightness, wood, synthetic resin or the like is preferred. When importance is placed on fire resistance, an inorganic fiber board, fiber-reinforced concrete or the like is preferred. The base 1 can have any shape, but use of a plate-shape material allows the sprayed heat-resistant material layer to have a uniform thickness. Therefore, preferred examples of the base include a woody board, a plastic board, a foamed plastic board, a cement board, a gypsum board, a fiber-reinforced cement board, a calcium silicate board, and a wood wool board.

An adhesive to be used for the adhesive layer 2 can be selected from any of organic adhesives such as synthetic resin adhesives or any of inorganic adhesives such as alkaline silicate in consideration of affinity with the base. When the base is a woody board, a synthetic resin board, or a concrete board, preferred is vinyl acetate adhesive, urea melamine cocondensation resin adhesive or the like. When the base is a combustible material such as a woody board, a synthetic resin or the like, a fire retardant such as phosphate fire retardant is preferably added to the adhesive. The applied amount of the adhesive varies depending upon the kind of the adhesive, but 5 to 100 g/$m^2$ of the adhesive is typically applied.

The sprayed heat-resistant material layer 3 comprises inorganic fibers and an inorganic binder as main components, and the layer may additionally contain aggregates, and small amounts of a tackiness agent, a coloring agent, an organic adhesive and the like. As the inorganic fiber, rock wool, glass wool, asbestos, and the like can be used, but rock wool is better in view of performance. As the inorganic binder, gypsum, silicates, lime, and the like can be used in addition to cement, but a cement such as blast furnace cement or portland cement is preferred. In addition, as the aggregates, bentonite, vermiculite, pearlite, inorganic powder, etc. can be added if

necessary. Use of vermiculite, pearlite, etc. improves lightness. Further, a pressure-sensitive adhesive such as carboxymethyl cellulose, a coloring agent, a paste, and an organic adhesive such as poly(vinyl acetate) can be optionally added in a small amount. The ratio of the inorganic fiber to the inorganic binder is preferably 1:0.5 - 2.

One preferred example is a material, for example, comprising 30 to 70 % of rock wool, 0 to 20 % of vermiculite, 20 to 40 % of portland cement or blast furnace cement, and 0 to 20 % of gypsum.

The sprayed heat-resistant material layer 3 is provided by spraying a material having the above composition toward the base 1 provided with the adhesive layer 2. As a spraying method, the following method are known: a wet method wherein a slurry of materials such as inorganic fiber, an inorganic binder, etc. is sprayed together with air; a dry method wherein dry materials are sprayed with water and air; and a semi-wet method wherein a slurry containing one of the inorganic fiber and the inorganic binder and the other as it is dry are sprayed with air. However, the dry and semi-wet methods using a slurry of the inorganic fiber are better in that the thickness and density of the sprayed heat-resistant material layer are made as even as possible. In particular, a board having the sprayed heat-resistant material layer 3, 10 mm or less in thickness, preferably about 5 mm, is excellent in view of handling operation and other points. However, since it is difficult to spray them uniformly so as to have such thickness, it is desirable to spray them according to the following method. That is, while a spray gun is held at a height of 1000 mm or more from the base 1, spraying is carried out just like falling snow. Thereafter, the sprayed layer is pressed with a roller or a trowel so as to finally have a predetermined thickness. Then, the sprayed heat-resistant material layer 3 having a uniform density and a smooth surface can be obtained. It should be noted that a common dry spraying machine can be used in this device.

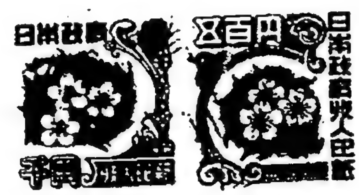
The heat-resistant board of the present device may be provided or coated with a thin film on its surface for beautiful appearance and dust proof. Further, an adhesive layer may be provided on the back surface of the base or reinforced screw holes, etc.

may be provided at required locations of the base for installing the heat-resistant board firmly and easily.

4. Brief Description of Drawing:

The figure is a cross-sectional view of a heat-resistant board of the present device. In the figure, there are a base 1, an adhesive layer 2, and a sprayed heat-resistant material layer 3.

Applicant of Utility Model Registration: Nippon Steel Chemical Co., Ltd.




（1500円）

実用新案登録願(1)

昭和48年2月5日

特許庁長官　三宅幸夫　殿

1. 考案の名称

積層板状体

2. 考案者

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鐘紡株式会社本部内

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48 015522

# 明　細　書

1. 考案の名称

積層板状体

2. 実用新案登録請求の範囲

繊維を混入した石膏層を芯材とし、その両面にガラスの組成がモル％で

| | | |
|---|---|---|
| $SiO_2$ | 60 | ～　67　％ |
| $R_2O$ | 16 | ～　20　％ |
| $ZrO_2$ | 12 | ～　16　％ |
| $P_2O_5$ | 2 | ～　5　％ |
| $B_2O_3$ | 1 | ～　4　％ |
| $R'O$ | 1 | ～　3　％ |
| $SnO_2$ | 0.5 | ～　6　％ |
| $CaF_2$ | 0.5 | ～　2　％ |

（上記組成中、RはNa, Kを、R′はCa, Mg, Ba, Znを夫々表わす）であるガラス繊維を混入したセメント層が積層されていることを特徴とする衝撃吸収能と防音、断熱性能に秀れた積層板状体。

3. 考案の詳細な説明　　3字挿入

本考案はガラス繊維を分散強化した石膏及びセメントの積層体からなる屋外構築物或は建築

用不燃ボードに関する。

従来より、セメント、石膏は主要不燃材料としての歴史を持ち、その性質は一般に圧縮には強いが、脆く引張り曲げに弱い欠点を有する。これを改善する方法としてポリマーを混入する方法、又は繊維を分散する方法が行なわれている。このうち繊維強化無機材料としては石綿セメント、木毛セメント、石綿炭酸マグネシウム、石綿珪カル、石綿石膏系が建材として多用されており、即ち、石綿が強化繊維として最も多用されているが、石綿は品質的バラツキがあり、公害問題との関連、更にはこれの供給枯渇の懸念があることから、近時ガラス繊維、合繊等の人造繊維の活用が有望視されるに至った。

ガラス繊維はその一般的性能として200～350kg／mm²の引張強力を有し、セメント、石膏等のマトリックスを補強し、亀裂伝播を防止するのに役立つもので例えば3～10重量％のガラス繊維分散量で石綿を15％以上分散した石綿セメント板相当の曲げ強度（180～300kg/cm²）が得られる。然しながらこれ程強力の高い材料でも厚さが伴なわないと衝撃吸収能が少ないのは勿論の事防

音、断熱特性も小さいので通常は他の材料と施工時にだき合わせにして使用するか、適当な断熱空間を置いて施工することが行われている。
又厚さを増加することによって衝撃抗力、防音、断熱性能を高めることも出来るが、元来比重の大きいセメントとの複合材であるのと強度向上の為に高密度に製造されるこれ等の材料は、軽量パネルとしての特性は完全に失なわれ用途が限定されてしまう。
又セメント強化材料として一般のガラス繊維例えばEガラスを使用したのでは、セメントモルタルに混練した場合、発生する水酸化カルシウムの塩基性によって特に長期使用期間中に強化ガラス繊維が浸蝕され、強度低下し材料の性能を劣化させるという欠点がある。
　一方ナイロン、ポリプロピレン、ビニロン、ポリエステルの如き合成繊維は破断強力及び高伸度の故に、セメント、石膏等のマトリックスに分散した場合大きな衝撃抗力、及び破壊エネルギー吸収能を発揮するが、材料のヤング率及び引張り曲げ強力の絶対値を向上することは出来ない。然してガラス繊維の高強力、高ヤング

率と、合繊の高伸度、弾性を生かす為両者を配合混練して使用することも考えられるがどうしても中途半端な材料にしかならない。 2字挿入
一方、構造材料としては軽量であることが要求され、気泡セメント、気泡石膏等が実用されているが、これらは気泡を含有しない同材質のものに比し脆く、くずれ易い等の欠点を有する。例 1字挿入
えば従来の石綿スレート、石膏ボードと比較すれば曲げ強力で約$\frac{1}{8}$〜$\frac{1}{20}$といちぢるしく低下するので単独で板状体として用いることは不可能に近い。

本考案者等は上記諸性質を満足する建築用材について研究を行い、発泡不燃軽量体の衝撃抗力並びに破壊エネルギー吸収能、防音、断熱性能と、ガラス繊維強化セメントの優れた強度特性に着目し、また特定組成のガラスが良好な耐アルカリ性能を有することを知見し、更に研究をすすめて本考案を完成したものである。

本考案の目的は、軽量にして且つ衝撃抗力と曲げ引張り等の強力並びに防音、断熱性能に優れた無機質板状体を提供するにある。

即ち本考案は、繊維を混入した石膏層を芯材

とし、その両面にガラスの組成がモル％で

| | |
|---|---|
| $SiO_2$ | 60 ～ 67 ％ |
| $R_2O$ | 16 ～ 20 ％ |
| $ZrO_2$ | 12 ～ 16 ％ |
| $P_2O_5$ | 2 ～ 5 ％ |
| $B_2O_3$ | 1 ～ 4 ％ |
| R′O | 1 ～ 3 ％ |
| $SnO_2$ | 0.5 ～ 6 ％ |
| $CaF_2$ | 0.5 ～ 2 ％ |

（上記組成中、RはNa, Kを、R′はCa, Mg, Ba, Znを夫々表わす）である 9字空白

ガラス繊維を混入したセメント層が積層されていることを特徴とする、衝撃吸収能と防音、断熱性能に秀れた積層板状体である。

こゝで言う石膏とは天然石膏を焼成、熟成した半水石膏の他、燐酸石膏、弗酸石膏、排煙脱硫石膏の他化学石膏を焼成后熟成して得られる半水石膏 $CaSO_4 \cdot \frac{1}{2}H_2O$ を意味し、必要に応じこれに他の無機物、例えば粘土、硅藻土、炭酸カルシウム、硫酸バリウム、硫酸マグネシウム、タルク、砂、ガラス粉末、球、大谷石粉末等、所謂充填材としての性能を持つものを水硬性を

阻害しない程度に混用出来る。

上記石膏に分散混入せしめる繊維としては、2～40㎜にカットされた繊維、例えばガラス、ポリエステル、ポリプロピレン、ナイロンがあり、これらの1種又は2種以上を単独又は適宜混用して分散使用するが、混入量はおよそ0.5～15重量％であり、一般に、引張強力、曲げ強力、せん断強度向上の為には均一分散の容易さを考慮して1～5％程度であるが、衝撃強度並びに破壊エネルギー吸収能を向上させる為には5～15％の範囲で多い程良好であり、軽量化にも役立つ。

又多孔質石膏とする為には一般によく知られるところのラウリル硫酸ソーダの如き空気連行剤を混和して空気泡の混入を行う他、マグネシウム、アルミニウム系粉末、過酸化水素水とサラシ粉、カルシウムカーバイトなどの化学反応を生ぜしめる発泡剤を添加することも出来、その比重は凡そ0.3～0.6程度である。

即ち、上記発泡石膏を用いることにより、軽量化を達成し、発泡体の欠点は繊維分散によって補いくずれ易さ、亀裂、脱落し易さをカバーし

且つ衝撃吸収能の他防音、断熱の諸特性を合わせて具えさせることが出来る。

又発泡及び繊維強化、石膏を製造するに際し、酢酸ビニール系、酸ビアクリル系、アクリル系、ポリウレタン系ポリエチレングリコール等の樹脂成分エマルジョン又は水溶液を添加すれば尚効果的である。特に本考案者等の実施結果としては

| | |
|---|---|
| 起泡剤として | 過酸化水素とサラシ粉 |
| 強化繊維として | ガラス繊維1%前后、ポリエステル繊維0.2〜0.3% |
| 樹脂成分として | 水溶型ポリウレタン |
| 他 | 石膏と水 |

を用いたものが好適であった。

芯材となる軽量発泡石膏に積層さるべき特定組成のガラス繊維によって強化したセメントとは一般水硬性セメント、例えばポルトランドセメント、マグネシヤセメント、アルミナセメント等、通常は最も多く使用されるポルトランドセメントを実効成分としたものにガラス繊維を分散混入したものであるが、ここに用いるガラス繊維はモル%にして $SiO_2$ 60〜67 $ZrO_2$ 12〜16%

$R_2O$ 16～20%、$P_2O_5$ 2～5、$B_2O_3$ 1～4%、R′O 1～3%、$S_nO_2$ 0.5～6%、$CaF_2$ 0.5～2%（但し上記組成中RはNa, K, をR′はCa, Mg, Ba, Znを夫々表わす）よりなる組成のガラスから得られるものである。

ガラス組成中に於て$ZrO_2$の存在により、耐アルカリ性が向上することは既に知られているが従来は10%程度しか混入し得なかったのに対し本考案に用いるガラス繊維は$P_2O_5$と$B_2O_5$の併用系で$ZrO_2$を12%以上に混入可能とし耐アルカリ性を向上せしめた他、$P_2O_5$がセメント中のCaと結合して水不溶の耐アルカリ性の抜群な燐酸カルシウムの薄膜がガラス表面に形成され耐アルカリ性と接着性向上がより良好に達成されるものである。

該ガラス繊維分散量としては製法によっても相異するが対セメント重量%にして0.5～15%好ましくは3～10%更に好ましくは3.5～5%であって圧縮によって密度を高め、養生条件を適切にすれば強力の抜群な用板となる。厚さは特に限定しないが2～10㎜厚のものが用いられ、比重は1.5～2.0のものを得、強度的性質としては例えば曲げ応力は200～300kg/㎠に達する。

繊維分散軽量発泡石膏層を芯材としガラス繊維強化セメント層とを一体的に積層するに当っては硬化后の石膏面に澱粉系、アクリル酸エステル系、酢酸ビニール系等通常用いられる糊料を層間に用いて圧着しても良く、又不飽和ポリエステル、エポキシ樹脂等の熱硬化性樹脂を必要に応じて硬化触媒と混用して塗布し加熱硬化し一体的に積層しても良いが、硬化未完の繊維強化石膏芯材の表面に片面宛、ガラス繊維分散セメントスラリーを配したる后適当な圧力を加えて厚みを調整したる后一体的に硬化しても良い。又、ガラス分散セメント硬化板の上に繊維分散石膏スラリーを流し込み硬化未完のうちに反転し裏面にもセメント硬化板を上のせし一体的に積層することも出来る。

以上に詳述した本考案にかかる積層板状体について以下図面によって説明する。

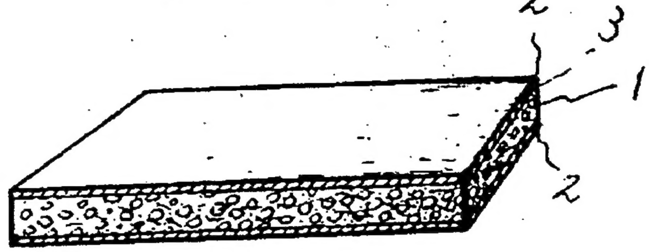
第1図は繊維分散発泡石膏層(1)を芯とし、この両面にガラス繊維が分散混入されたセメント層(2)を積層したものの一部切欠斜視図である。積層界面(3)は積層の手段によって滑面、凹凸面を形成することが出来るが、いずれにしてもそ

の積層は強固である。なお、夫々の厚みの比率としては、石膏芯材層が全厚みの25～75%の範囲であるとよく、この厚みが25%よりも少いと断熱性能や遮音性が得られず、また軽量化も僅かであって好ましくなく、一方、厚みが75%を超えると強度的性質が低下して好ましくない。なお、両面に積層されているセメント層の厚みは、同じでも異っていてもよく、使途に応じて適宜である。なおまた図示しなかったが、上記板状体は軽量芯部と高密度高強度の外層板が一体的に積層されている為、芯部と外層板との厚さによっても異なるがその比重はおよそ0.6～1.2の範囲のものが自由に得られ、石綿スレート板のみで同様な厚さのものと比較して軽量であるにもかゝわらず、はるかに秀れた強力を有し、更に衝撃吸収性と防音性、且つ気泡含有から来る断熱性能もまた良好であって各種建材用にその工業的利用価値の高いものである。

4.　図面の簡単な説明

第1図は発泡石膏芯材(1)とその両面にガラス繊維混入セメント層(2)が積層されている本考案にかかる積層板状体の斜視説明図である。

第1図




Reference 1
Fig. 1
1: Fiber-reinforced Gypsum Core
2: Fiber-mixed Cement Layer
3: Boundary Surface between Gypsum Core and Cement Layer

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5. 添付書類の目録

(1) 明　　細　　書　　　1通

(2) 図　　　　　面　　　1通

(3) 願　書　副　本　　　1通

(4) 委　　任　　状　　　1通

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